**#SB277:** Communications on Twitter about California's law eliminating non-medical exemptions for childhood vaccinations

Heather Corliss, MPH, PhD 8/1/16

# Goals of SB277 Project

- Analyze Twitter communications about SB277 with respect to:
  - 1) Communication theories, i.e., Multi-level Model of Meme Diffusion (Spitzberg, 2014)
  - 2) Social Network Analysis
  - 3) Behavioral Health Analysis
  - Integration of these analytic methods and perspectives













Reason #3 I want SB277 to pass:

Uniformly high vaccine uptake rates help protect those who cannot be vaccinated.

If anti-vaxxers think their children should be able to avoid vaccines no matter how small the risk, shouldn't I be able to avoid unvaccinated children no matter how small the risk?





#### **Vaccine Exemption SMART dashboard**



#### http://vision.sdsu.edu/hdma/smart/vaccineExemption



# Prevalence of tweets mentioning SB277

 Between May 27, 2015 and April 29, 2016, 133,755 tweets mentioning SB277 were downloaded by SMART Dashboard

# Timeline of Some SB277 Events

Date	Event	
2/19/15	SB277 introduced by Richard Pan, MD	
6/25/15	SB277 passed CA Assembly floor	
6/29/15	SB277 passed CA Senate floor	
6/30/15	CA governor Davis signed SB277 into law	
7/28/15	Dr. Pan battled recall by anti-vaccine activists	
9/16/15	Trump linked child vaccines to autism in Republican primary debate	
9/30/15	Referendum to repeal SB277 failed to get enough signatures	
10/13/15	CA governor Davis signed SB792	
1/11/16	Mark Zukerberg posted picture of daughter being vaccinated	
2/10/16	Anti-vaccine billboards go up to coincide with Super Bowl 50	
4/13/16	Robert De Niro supported anti-vaccine movement on TV	
7/1/16	SB277 went into effect	

# Social Network Analysis

## Overview of Social Network Analysis

- To characterize the social networks of twitter users tweeting about SB277
- Tweets within 5 days of 9 major event (2 days before and 2 days after) were analyzed
- In-degree, out-degree and page-rank analyses performed to understand similarities and differences

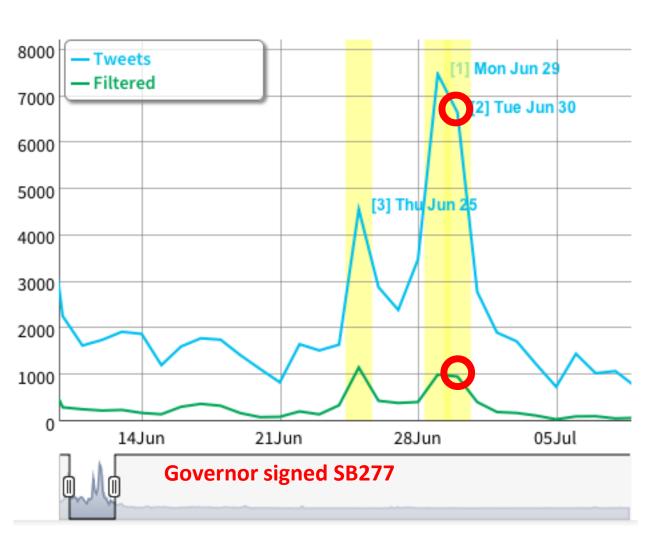
# In-Degree, Out-Degree & Page Rank

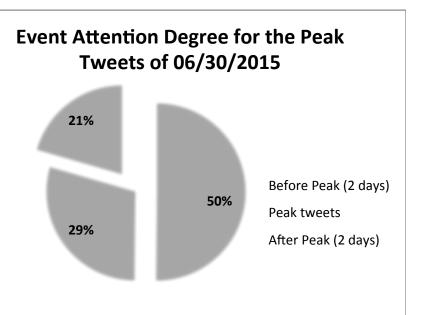
- In-degree measure of how popular someone is
  - Number of times a person is mentioned (@) and/or their tweets are retweeted by other users
- Out-degree measure of how active someone is
  - Number of other twitter users mentioned or retweets by a user
- Page-rank similar to In-degree, but weighted by the influence of the people mentioning and retweeting them

# **Example:**

6/30/2015 - Governor signed SB277

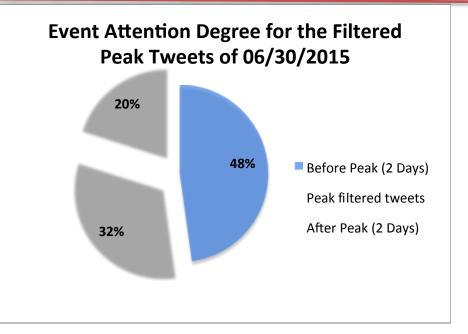
# Tracking Events in Smart Dashboard





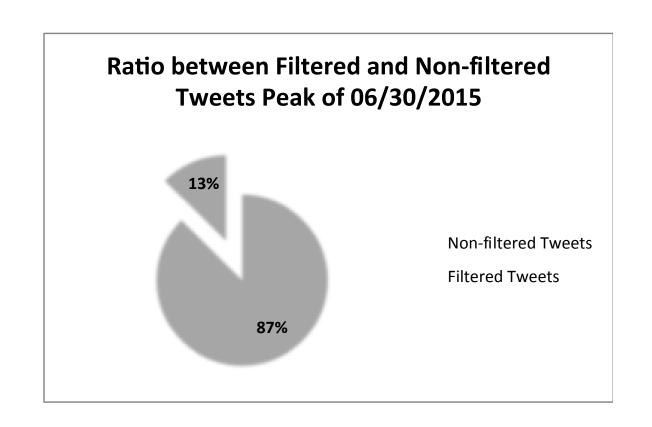
Before Peak (2 days)	11839
Peak tweets	6915
After Peak (2 days)	4852

# Total number of tweets (5 days): 23,606



Before Peak (2 days)	1483
Peak filtered tweets	996
After Peak (2 days)	624

# Total number of Filtered tweets (5 days): 3,103



# Word Cloud of all 5 Day Tweets (peak 06/30/2015)

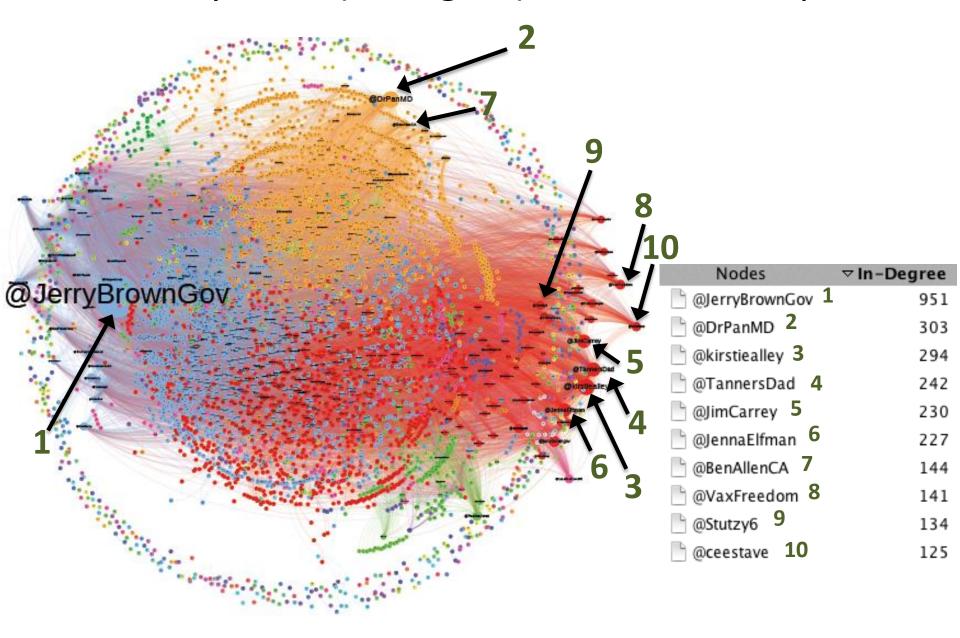
#### **All Tweets**

#### boy tomberryhill injured lisasgonnasnap luciadepaxtoniafind millionmamas tinamrdh politicalportset father tdbcalivaxchoicesbrecalls never speakinguphold kidgovjerrybrown exemption vaccinated doesnt perfect speakinguphold kidgovjerrybrown exemption vaccinated doesnt perfect sdb classroom fathers pharma demandiability gotitsmepanda son autism ssisoccermomknow list today mandatory act stephigin measles lies share wont legacy jimcarrey governor httptcdb read thousands lift way join keep test education see kirstiealley child lalaruefrench food hearsay day oppose lifelighted choice gov votethank kids schoolchallenge fri parental bought call hdb can full brown public lindacngal demand stutzy filpeople httpdb mine news sbdb <sub>stop</sub>annebgust medical many lets httpsdb farstatepiz lanow httptcodb laws rik new bless dont pease amp fir parentsneed good htdb fed one jerry pease senate per real senate per rights and coforho now petition big safe real senateph rights california bill sign wantdenied truth nosb biegenzahn cdcwhistlebloweriiiJust ask vaxfreedom old doctorsaway crisis tannersdadhealth protect risk yescapitol schools said must vaccination drpanmd make support greatgoing feardotfranny mandates ceestave signatures of enough fully mandated life brotony muhammad exemptions beuermanasd isnt casenatedems unconstitutional cdc live asmrocky die proparentrights bec

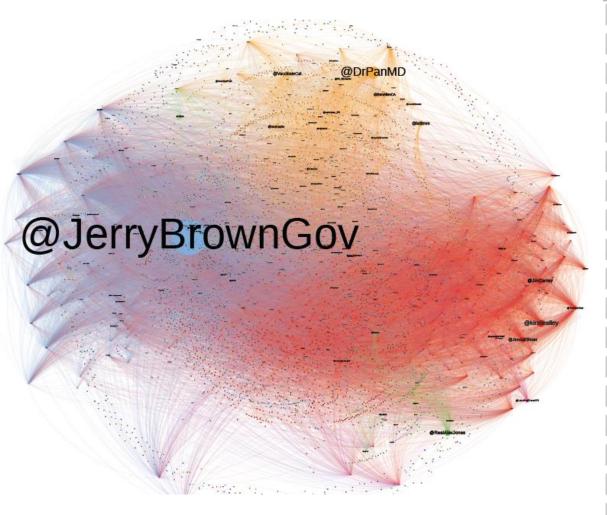
#### **Filtered Tweets**

floor meet parentalrights mandatory robertkennedyjr disappointed pan fraud clear diseases tell going discriminatory choose consent true thing vaccinated healthy know its mepanda kirstie alley assignst mandates passes truth overreaches noschooloneshot pass thanks tockvia forced high mother deaths thousandsdenies cali disease pay allows doesn't freedom one thousandsdenies voting families day signing unconstitutional beliefsee many baby families allen unconstitutional beliefsee many deny food full can talkschool legacyrisk jimcarrey saysdi mandate public protect vaccines now support sad fair anti odelistilu poblika old thank voteright sign honorgood live exemptions lawthank voteright sign honorgood loveneed much rights hearus vaccineswork lies heyokay gov rights hearus vaccineswork lies care time friends helpmine browndont helpmine browndont yay yaxed schools forces vaccineswork lies helpmine browndont bill drpanmd away yay vaxed schools forces vaccineswork lies helpmine browndont must reaction legal let religious want please kids just parental etc. think keep med crisis ampchildren ask cant stop great qualify fathers yet nosb take isnt get california people pbehorrid wont theres isnt get california people pbehorrid never speaking big child today parents signed yes vetosb reason beliefs draconian opposelife exemption pharmavaccination science make stamps also wronggovernor personal choice still lear make stamps also lizdi deserve unnecessary ssisenate govjbrown passing calefatiman proud opposition exemp cdcwhistleblower passed constitutional antivax senatedems lives rate hope voted news end mariariveraoc laws

## All 5 Days SNA (In-degree) of 06/30/2015 peak

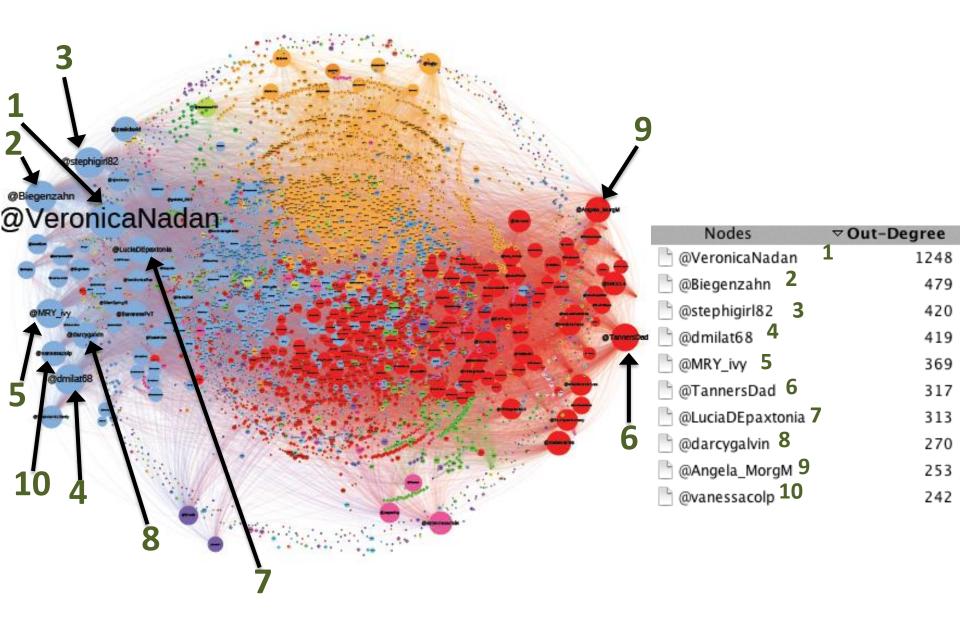


### All 5 Days SNA (Page Rank) of 06/30/2015 peak



Nodes	<b>▽ PageRank</b>
@JerryBrownGov	0.041
🗎 @DrPanMD	0.013
@kirstiealley	0.007
@RealAlexJones	0.006
@JimCarrey	0.006
🗎 @JennaElfman	0.005
alatimes @	0.005
@VaccinateCal	0.005
@BenAllenCA	0.005
🗎 @tarahaelle	0.004
🗎 @LaLaRueFrench75	0.003
🗎 @TannersDad	0.003
@VaxCali	0.003
🗎 @ashulman_RS	0.003
@AmerAcadPeds	0.003
@RS_JSkropanic	0.003
@VaccineXchange	0.003
@WIRED	0.003
@SenatorMoorlach	0.003

### All 5 Days SNA (Out-degree) of 06/30/2015 peak



3 major groups: red, blue, and orange.

#### Based on In-degree:

- Jerry Brown has the highest in-degree which correlate with the event (Jerry Brown signed SB 277).
- Even though the highest in-degree (JerryBrownGov) was found within the blue group, the majority of the group in red represent the utmost influential opinion leaders in the network, and are mostly opponents of SB277.
- The group in orange illustrated by Dr. Richard Pan and Ben Allen (high in-degree), are both supporters of SB277. Dr. Pan authored California legislation in 2012 that forces parents to consult with a doctor before using exemptions for vaccines.

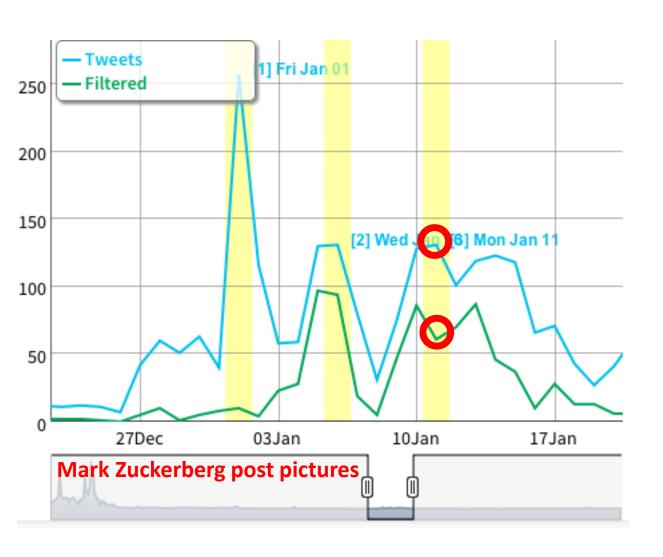
#### Based on Out-degree:

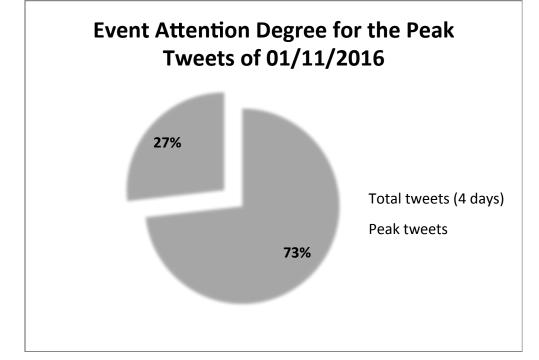
The majority of the group in blue represent the chatters, which are interested in re-tweeting or mentioning other user tweets. They are characterized by the diversity within its members between opponents (VeronicaNadan, Out-Degree) and advocates (JerryBrownGov, In-Degree) of SB 277.

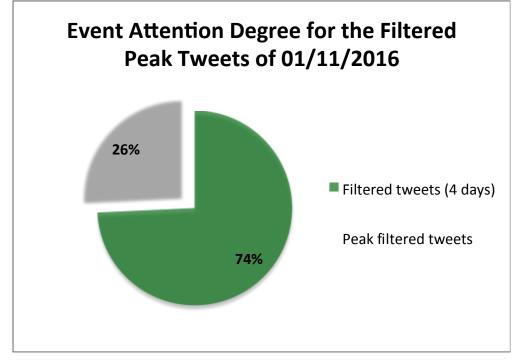
## **Example:**

# 01/11/2016 - Mark Zuckerberg post pictures

# Tracking Events in Smart Dashboard







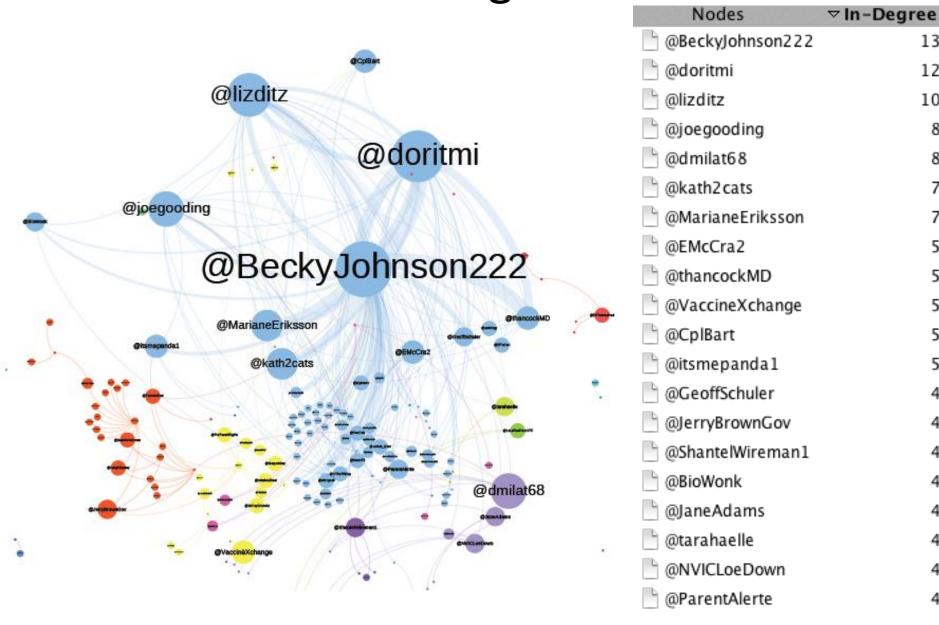
#### **All Tweets**

childmany vaxwithme jerrybrowngov<sub>bad cause</sub> wrong shot httpstdb Vaccinechoiceri safety dark vaccineswork die felixwankelhttpsdbyrs claim dpt see fix tell let know geoffschulerkolyin libertylives goal death geoffschulerkolyin libertylives goal measles vaccinated ppl catetaylor true support vaccinexchange letschildren

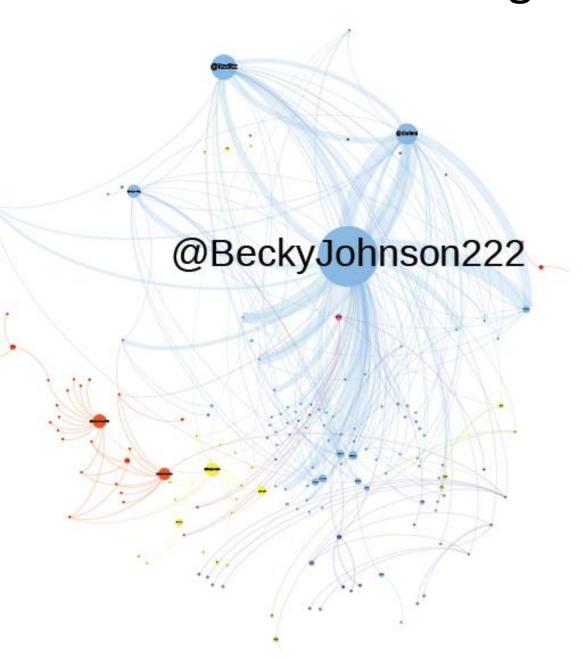
#### **Filtered Tweets**

injured studies point now die use bigpharm really bodies vaxcalc says aetiology drbrignall saying adverse cause inthethday cdcwhistleblower killed must showing aluminum thimerosal true libertylives bad 9 Skolyin measles sick wrong rate many chrisdarniellechild report using disease chicken autism claim thats health meanneed away lastkath every soup think cantabbiker emccra dangerous single

## In-degree



# Out-degree



Nodes	<b>▽Out-Degree</b>
@BeckyJohnson222	70
🗎 @lizditz	27
🗎 @doritmi	22
@soccermom818	13
🗎 @Biegenzahn	13
ajoegooding	12
🗎 @defendressofsan	11
🗎 @UrieBay	7
apinksky4U	7
alnThe7thDay	6
🗎 @bgordski	6
athancockMD	5
@MJScanlonOH	5
amimuluxArt	5
🗎 @drpaulmorgan	4
🗎 @Just4TheCause	4

## Top 5 Influential Users – In-degree Analysis

Users	Count
VaccineXchange	8
doritmi	7
NVICloeDown	7
joegooding	6
SB277Referendum	6
ceestave	5
DrPanMD	5
itsmepanda1	5
jonrappoport	5
LaLaRueFrench75	5
Stutzy6	5
TannersDad	5
DrThomasPaul	4
EMcCra2	4
HealthRanger	4
JerryBrownGov	4
lizditz	4
YouTube	4

		The Vaccine Xchange is a place where people interested in vaccine safety can come	
VaccineXchange	Neutral	and share their stories, find answers, and read the latest scientific studies.	
		Dorit Rubinstein Reiss is a Professor of Law at UC Hastings College of Law. She has also	
	Pro-VAX	worked for the Hebrew University of Jerusalem and the Israeli Ministry of Justice's	
doritmi		Department of Public Law.	
		NVIC is a 501(c)3 charitable, non-profit educational organization founded in 1982.	
NVICloeDown	Neutral	NVIC launched the vaccine safety and informed consent movement in America.	
		New Orleans Saints! Conservatarian, #1A #2A #GlutenFree #ProLife #CCOT #PARaven	
joegooding	Anti-VAX	#TrumpTrain Fwd by Hannity, Cupp, Corsi, Feisty, Reghetti, Duff, Starnes. PARaven.net	
SB277Referendum	Anti-VAX		
		Activist for children, Mom of vaccine injured child. http://B1less.com Go to	
ceestave	Anti-VAX	#CDCwhistleblower, http://VaxTruth.org or just stay here!	
	Pro-VAX	Dr. Pan, a pediatrician and educator, represents Sacramento in the California Senate.	
DrPanMD	PIO-VAX	With his wife, he raises two sons and runs a small business.drrichardpan.com	
		Answer is out there Head in hands, crying, she looked up at me & said well where is it?	
itsmepanda1	Anti-VAX	Vaccination=medical procedure. Don't give up your right to decide.	
jonrappoport	Anti-VAX	Jon Rappoport has worked as a free-lance investigative reporter for over 30 years.	
LaLaRueFrench75	Anti-VAX	Laura LaRue is an ElectroPOP singer in san fransisco (from french origine) (against SB27	
Stutzy6	Anti-VAX	account against sb277 (talking about whistleblowers and falsify vaccine effectiveness)	
TannersDad	Anti-VAX	One of the most Influential and Active Parent Advocates for families dealing w Autism 8	
		Past Life Therapy Center® Founder/Therapist with #PastLivesTherapy Author, Dr. M.	
DrThomasPaul	Anti-VAX	Netherton. PastLifeTherapyCenter.com PastLifeRegression.com #pastliferegression	
EMcCra2	Anti-VAX	Joined CDCwhistleblower community to help bring reform to vaccine policy.	
HealthRanger	Anti-VAX	Consumer health advocate and editor of NaturalNews.com.	
JerryBrownGov	Pro-VAX	Sign SB277	
		Dyslexia consultant, autism advocate, and blogger. @k_5remediation for dyslexia; see	
lizditz	Pro-VAX	thinkingautismguide.blogspot.com for autism advocacy. lizditz.typepad.com	
YouTube	Neutral		
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## Top 5 Influential Users – Out-degree Analysis

Nodes	Count
Biegenzahn	8
joegooding	7
lizditz	7
defendressofsan	6
doritmi	6
dmilat68	5
MRY_ivy	5
Beckyjohnson222	4

		Native NYer in SoCal. I'm an ADVOCATE for ALL CHILDREN NATURAL health REAL food	
Biegenzahn	Anti-VAX	CLEAN air TRUTH and so much more! BE KIND and WAKE UP ♡	
		New Orleans Saints! Conservatarian, #1A #2A #GlutenFree #ProLife #CCOT #PARaven	
joegooding	Anti-VAX	#TrumpTrain Fwd by Hannity, Cupp, Corsi, Feisty, Reghetti, Duff, Starnes. PARaven.net	
		Dyslexia consultant, autism advocate, and blogger. @k_5remediation for dyslexia; see	
lizditz	Pro-VAX	thinkingautismguide.blogspot.com for autism advocacy. lizditz.typepad.com	
defendressofsan	Anti-VAX	#FireWoman burning bright who loves drinking in the gift of Chris Jericho baby!	
		Dorit Rubinstein Reiss is a Professor of Law at UC Hastings College of Law. She has also worked	
	Pro-VAX	for the Hebrew University of Jerusalem and the Israeli Ministry of Justice's Department of	
doritmi		Public Law	
		Mom of 6, grandma of 3married to my husband Jeff for 27 years. Conservative Christian.	
dmilat68	Anti-VAX	#ohHILLno #RecallJerryBrown #canpan #NOMANDATORYVACCINES	
MRY_ivy	Anti-VAX	fierce mom, phd statistician, health nut.	
		Blogger, teacher, muck-raker, career malcontent, Santa Cruz 11, NO on SB277but I take lots	
Beckyjohnson222	Anti-VAX	of coffee breaks!kyjohnsononewomantalking.blogspot.com	

## Conclusion

- Filtered tweets had higher attention degree than the non filtered tweets when compared to the 5 days events collected.
- The content analysis for both, filtered and non-filtered tweets were related to specific events.
- The dynamics of the social network changed across time and events – influence depended on time and the event.

# Behavioral Health Analysis

# Overview of Behavioral Health Analysis

- Purpose to understand the sources,
  sentiments, and content of tweets on SB277
- Apply health behavior frameworks & theories to analyze tweets on SB277
  - To what extend do behavioral theory constructs occur in Twitter communications about SB277?
  - What factors are associated with the occurrence of behavioral theory constructs in Twitter messages about SB277?

# Steps of the Process

- 1) <u>Literature review</u> to identify behavior theories that predict whether parents vaccinate their children
  - Health Belief Model (Most commonly used)
  - Theory of Reasoned Action/Planned Behavior
- Develop a code book to code SB277 tweets on key variables
  - Source characteristics (e.g., individual vs. orgs)
  - Sentiments (e.g., tone)
  - Content information (e.g., behavioral theory constructs)
  - Multi-level Model of Meme Diffusion domains

# Steps of the Process

3) <u>Select tweets for analysis</u> – determine inclusion and sampling criteria

### 4) Code and analyze tweets

- Analyze tweets in conjunction with Social Network Analysis
- Analyze a representative sample of individual tweets to understand individuals' communications about SB277
- 5) Write paper for peer-review publication